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ABSTRACT

To identify environmental technician positions in the public and private sectors of the San Francisco Bay Area as well as to determine the skills and knowledge necessary for employment in the field, questionnaires were distributed to companies, agencies, individuals of the private sector in the area, and 33 institutions offering an Occupational Curriculum in Environmental Education. Findings derived from the data include: (1) At present, there exists no immediate employment placement locally for 2-year trained environmental technicians, therefore it would not be feasible to institute such a program in this vicinity, and (2) The environmental technology topics most often offered were Introduction to Environmental Technology, Disease Prevention Technology, Pollution Prevention and Control Technology, Resources Conservation Technology, and miscellaneous courses. (SN)

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I. INTRODUCTION

There has been considerable dialogue over the past several years relative to the need for establishment of educational programs to prepare persons for employment as environmental technicians. Considerable confusion has existed relative to establishing training programs within the area of environmental technology.

On March 1, 1971 the Office of the Chancellor, California Community colleges, organized a seminar to explore manpower needs in the field of environment within the San Francisco Bay Area. The purpose of this project and the research contained within was a direct outgrowth of that seminar.

1) Apparent Immediate Need for Environmental Technicians

> ". . . the problem of environmental pollution is not new, though it is bigger now than ever before. What is new is the growing desire and demand to do something about it. In response to public pressure, the Congress and the state legislatures have passed much new legislation to deal with air, water, and land pollution, substandard housing and urban decay, radiation hazards, and solid waste disposal. This has resulted in the creation of many new programs on all levels of government and industry.
>
> These new programs have, in turn, created thousands of new jobs for environmental health technicians and sanitary inspectors with local and state health departments, for water and wastewater treatment plant operators with municipalities and industry, for food and milk products inspectors with agriculture departments and the milk and food industry, for air and water pollution control technicians with consulting engineering firms, and for technicians with public health laboratories."[1]

The need for environmental control suggests an increase in the number of personnel in the capacity of trained individuals to adequately meet this need. Further, statements issued by concerns such as the Environmental Protection Agency, Environmental Science and Technology,

and the United States Office of Education indicate that there will be a phenomenal need for trained technicians in the environmental field.

> "By 1980 the rapid population growth will have created environmental problems requiring 214,000 trained technicians. At the present rate of training - less than 1,000 new graduates per year - there will not be enough trained people to meet the demand. Educational facilities and teachers must be updated and added to insignificant numbers for the necessary production of trained technicians needed over the next five to ten years."[2]

> "By 1980 at the present growth of the population and environmental problems created by that growth, there will be a need for 198,000 trained technicians. At the present rate of training at the technician level, less than 1,000 new graduates per year, there will not be enough trained people to meet the demand."[3]

> And finally, "The long-range prospects for technicians are favorable. By 1975 - less than three years off - more than one million new interesting technical jobs promising good salaries will open in this country, predicts the U. S. Office of Education."[4]

These figures conservatively suggest that demands varying from a 100-200% increase in trained technicians will be needed to meet needs over the next few years. Yet the specific areas in which these technicians will be needed, and exactly where they will be employed is not so easily answered.

A need definitely exists, yet programs must not be initiated if they result in unemployed or unemployable graduates. Many of the sources that predict great increases in trained technicians suggest that institutions evaluate and assess the need for these trained persons in their local areas and state before proceeding.

This has been the precise purpose of this study, namely, to identify current and projected environmental technician positions in both the public and private sector of the San Francisco Bay Area.

II. STATEMENT OF PROGRAM

The intent of this research was to identify environmental technician positions in both the public and private sector of the San Francisco Bay Area. Additionally, the knowledge, skills and attitudes necessary for employment in these positions were researched and described. A projected estimate of available environmental technician positions over the next five years also was made subsequent to research. It is intended that the results of this survey and information obtained will be used by community colleges and local high school districts to determine the need for training programs in environmental technology in the San Francisco Bay Area.

III. RESEARCH METHODOLOGY AND FINDINGS

Initially, Federal, State and County agencies, members of the academic community, as well as persons from the private sector were contacted regarding job opportunities for environmental technicians. These contacts were also surveyed as to their knowledge and predictions of positions available over the next five years. The results can be found in the following chapter.

Subsequently, a questionnaire was devised to determine the necessary skills and knowledge necessary for employment as a general environmental technician should positions become available. The curricula of schools in the United States currently offering environmental education programs were researched. Their curricula and specific course topics were incorporated into the aforementioned questionnaire. This document was distributed to companies, agencies, and individuals of the private sector in the Southern San Francisco Bay Area. Specific results, findings, and general recommendations can be found in the following brief.

2) Assessment and Projection of Job Opportunities for Environmental Technicians With Up To Two Year's Educational Background

Various Federal, State, and County agencies, individuals from the academic community, as well as individuals from private sectors were contacted personally and/or by letter regarding job opportunities for environmental technicians. In every instance these responsible persons were informed as to the nature of our study into the needs of the development of an environmental-ecological technology program. They were also asked for any information that they might have to assist us in determining the number of current and projected employment positions for environmental technicians and technicians with a maximum of two year's educational background.

The response to our inquiries was not encouraging. As mentioned previously, predictions estimated thousands of new jobs for environmental health technicians, yet the general responses indicated very few jobs now available and almost no predictions for future employment. Some representative agencies contacted and excerpts from their correspondence follow:

Contra Costa County Health Department William R. Martin Supervising Sanitarian	". . . No Assistant Sanitarian positions allocated at this time. . ." All other positions in the Environmental Health Division are filled.
City and County of San Francisco Department of Public Health San Francisco, Calif. Francis J. Curry, M.D. Director of Public Health	"Currently, the requirement for eligibility to take the registered Sanitarian's examination is graduation from a college or university with a minimum of 30 units of basic science. It is difficult to provide you with a projection of future employment positions. It can only be predicted that there will be a gradual increase, over the years, in available positions of this type. This will occur as the general public becomes more aware of the environmental health problems that demand adequate controls."

United States Department of Agriculture Soil Conservation Service Berkeley, California C. R. Hillebrandt Personnel Officer	". . . we do not anticipate filling any technician positions in California."
State of California- Resources Agency Department of Water Resources Sacramento, California Robert R. Finnegan Personnel Analyst	". . . at this time we are in the process of making reductions in staffing throughout the Department due to completion of phases of the State Water Project. These reductions will continue for the next two and one-half to three years. Thus, there is very little likelihood that we will be making any new hires during that period among the engineers and technicians working on the Bay Area Programs."
State of California- Resources Agency Air Resources Board Sacramento, California John E. Hvizdak Administrative Officer	"The Air Resources Board has almost no employment opportunities in the Bay Area."
Alameda County Health Care Services Agency W. W. Sampson, Ph.D. Health Biologist Bureau of Environmental Planning San Leandro, California	"At the moment, all positions are filled. We do not have an intermediate position, that is, one that requires two years of education."
Northern California Committee for Environmental Information Berkeley, California Mary Whittemore Executive Secretary	No salaried positions at this time and "do not expect to be otherwise in the near future."
State of California Department of Education Sacramento, California Rudolph J. H. Schafer Consultant in Conservation Education	"Mr. Smith (State Director of Vocational Education) feels that the employment field for environmental technicians is rather restricted at present, but that it may open up later as interest in environmental improvement increases."

University of California, Riverside Statewide Air Pollution Research Center O. Clifton Taylor Associate Director	"In recent months there has been a great deal of effort put out by several institutions to retrain unemployed space scientists for work in the field of ecology. Many of those have completed their training in the last few months and as they search for positions I am sure the estimation of available positions will change rapidly."

* For list of Federal, State and County agencies, with individuals from the academic community and private sectors contacted, see Appendix I.

As can be surmised, there exists, at this time, no immediate employment placement locally for two-year trained environmental technicians. Many sources stated that as public awareness of environmental health problems increases, the employment needs may change, but few were willing to estimate future developments.

Lawrence W. Alkire, Personnel Analyst for the Bay Area Air Pollution Control District stated, "We are in the process of adding 57 new people to the staff making a total of 165 positions." After surveying the complete set of the Bay Area Air Pollution Control District Position Descriptions, we found available 3 positions for individuals possessing 2 years of college with specializations in a physical science and engineering. These job titles were "Air Pollution Field Technician" (2 positions) and "Assistant Air Pollution Engineer" (1 position). 39 positions required a four-year college or university degree, and the remaining 16 were clerical positions.

In addition, the "California Occupational Guide - California Department of Human Resources Development" and the "California State Personnel Board Specification Bulletins" were surveyed. For some 41 Environmental Ecology related jobs, only 12 positions were available for those possessing 2 years or less of college education. These 12 positions were found to be in areas such as Sanitation, Water Treatment, etc. in which there is very little turnover and existing training programs available.

3) Analysis of Survey Regarding Employment Opportunities for Environmental Technicians

In view of the correspondence received and surveys made, we can find no evidence, at this time, of employment opportunities in the San Francisco Bay Area sufficient to warrant the initiation of a new Environmental Technician Program. Perhaps technicians may fill more effectively and less expensively jobs currently held by valued industry professionals in the future as the demands increase significantly. There does exist a "need" for Environmental Technicians, however until public awareness and interest brings about legislation which will, in turn, encourage the private sector to create job opportunities, this need cannot be fulfilled. The private sector, at this time, cannot realize a profit from funds spent in Environmental-Ecology; money spent results in additional expenses with little return. One must also consider the general economic situation --- there exist very little employment opportunities in any field.

Mr. Frank M. Covington, Director, Air and Water Programs Division, Environmental Protection Agency, San Francisco, California, sums up our findings in his correspondence of January 25, 1972:

> "We have recently concluded an employment survey of more than three hundred fifty wastewater treatment plants in California, and we have had several discussions with the California State Department of Human Resources Development in regard to current and projected employment needs in the environmental area. We have found that the current and short run prospects for employment are extremely poor . . . Due to the relatively depressed state of the economy the jobs required to meet current environmental needs have not been created. We believe, that with an amelioration in economic conditions, the projections . . . will eventually be realized."

This poses a new direction suggested by the President's Council on Environmental Quality recommended in their first report to Congress:

> "There is need for new programs to train technicians who have fundamental technical skills and who can easily adapt to constantly emerging job categories. It may be possible, for example, to modify, coordinate, or merge some of the present specialized technician programs into broader environmental technician programs."[5]

Presently, private sector employers have suggested that existing employees would benefit from Environmental-Ecology courses relative to their specific needs. Thus, employees could gain additional training in Environmental-Ecology and therefore incorporate their new knowledge into their present job descriptions. This would result in no additional expense to employers.

4) Identification of the Skills/Knowledge Necessary for Employment as Environmental Technicians

The identification of the skills/knowledge and attitudes necessary for employment as Environmental Technicians via a direct job task analysis is not feasible at this time. However, in order to determine these skills and knowledge essential for potential employment or additional training of existing employees a modified approach was devised.

This approach, in general, consisted of contacting those schools nationwide having established courses in Environmental and related Technologies. The curricula from these schools was analyzed as to specific course content from which was compiled topics covered. From these topics and information gathered from persons contacted regarding job opportunities, a questionnaire was developed to determine the necessary skills and knowledge necessary

for employment as a general Environmental Technician. This questionnaire was then circulated to the private sector in the Southern San Francisco Bay Area.

Summary of Environmental Education Curricula Offered, Courses Taught, Specific Topics Covered, and Subsequent Skills/Knowledge Questionnaire

a) Description of Schools in the United States Offering Occupational Curricula in Environmental Education As of 1969

As of the aforementioned date, merely 17 schools nationwide offered Environmental-Ecology Programs. At that time, the programs were very general and emphasis was placed in Water - Wastewater Technology and Environmental Control Technology. It should be noted that only one school in the state of California offered a program at this time, that is, Contra Costa College in San Pablo, California. Their program was in Water Technology. The summary of these programs and resulting emphasis by these 17 schools is presented in Table I below:

Table I Programs Offered By 17 Schools As Of 1969

Program Description	Number of Schools Offering
Water - Wastewater Technology	6
Environmental Control Technology	4
Environmental Engineering Technology	2
Air Pollution Technology	2
Sanitary Engineering Technology	1
Water Technology	1
Solid Waste and Wastewater Technology	1

In contrast, as of 1970-71 the scope of institutions offering Environmental-Ecology Programs had broadened tremendously. The number of schools with established programs had risen to 201 and the content had progressed from the general to the very specific.

This tremendous increase nationwide demonstrates clearly the increased interest in Environmental Programs. It must be noted that within this 2 year period, the number of programs in California alone had risen from 1 to 40.

b) Schools Contacted Regarding Environmental Curricula

Requests for information and course content were sent to a representative 63 schools nationwide currently offering Occupational Curricula in Environmental Education. Thirty-three of these polled were selected as to the specific information they were able to give with respect to the purposes of our study. In addition, these 33 institutions were chosen as representative of the scope of Environmental Curricula presently established nationwide.

c) Summary of the Course Titles Offered Grouped According to Academic Disciplines

Academic Disciplines included as follows:

a) General Environmental Technology and/or related courses
b) Chemistry
c) Biological Sciences
d) Engineering
e) Mathematics
f) Physical Sciences (Other than Chemistry)
g) Business
h) Social Sciences
i) Language Arts
j) Physical Education and Health Education
k) Instrumentation
l) Miscellaneous

The major emphasis of the 33 representative schools in the General Environmental Technology courses were Water Pollution -

* For details regarding the increased scope of programs offered in the 1970-1971 period, see Appendix II.
* See Appendix III for complete list of institutions contacted.
* See Appendix IV for curricula titles distribution of the 33 institutions utilized.

Wastewater Treatment, Collection and Control, Air Pollution Control, and Principles of Environmental Health. It should be noted that in general approximately 25% of total hours are devoted to these environmental technology courses, while 50% are given to "background" subjects and the remaining 25% to liberal arts and physical education courses.

d) Environmental Technology Topics Obtained From Course Syllabi of the Thirty-Three Institutions Reviewed

The Environmental Technology Topics as surveyed from the syllabi of the 33 selected schools can be divided into five general areas. They are as follows:

a) Introduction to Environmental Technology
b) Disease Prevention Technology
c) Pollution Prevention and Control Technology
d) Resources Conservation Technology
e) Miscellaneous

Listed beneath each of these categories (See Appendix VI) are basic course contents. These are included so as to further reveal what these general topics emphasize and what students may be expected to learn. Course contents are not intended to be all inclusive nor do they specify number of class hours, as each institution places their major emphasis in the area of their specialization.

The Environmental Technology Topics as outlined may be valuable for anyone contemplating the initiation of an Environmental Technician Program. One may expand of the topics presented or use them for guidelines. Their usefulness can be

* See Appendix V for analysis of course titles offered grouped according to academic disciplines.

imagined from the fact that thirty-three representative schools across the nation considered these topics of major importance to their students seeking an Occupational Environmental Education.

In addition, these topics provide us with guidelines to derive basic skills and knowledge that employers would find desirable in their environmental technicians when employment positions become available.

e) Employee Skill/Knowledge Questionnaire

Based on a) analysis of Environmental Technology Topics now offered by thirty-three established programs; b) feedback from individuals and agencies contacted initially; and c) select guideline publications (refer to bibliography), a questionnaire was compiled listing 111 basic skills and knowledge. These were sent to 210 companies, agencies, and individuals of the private sector in the Santa Clara County. Forty-eight responses were obtained from manufacturing concerns.

It was explained at the outset that should Environmental Technician positions become available or should they desire their current employees to receive additional training in Environmental Technology or related fields, which skills/knowledge listed in the questionnaire as: 1) essential; 2) desirable; and 3) unnecessary. They were also asked to include any skills that may have been omitted that were appropriate to their job descriptions at the Environmental Technician level. A summary of types of manufacturers contacted is as follows:

* See Appendix VI for complete list of Environmental Technology Topics as compiled from the syllabi of the thirty-three representative institutions selected for review.

Table II Types of Manufacturers Contacted Grouped According to Industrial Concerns

Chemical	Food	Electronics	Heavy Machinery	Paper Products	Miscell.
8%	22%	22%	32%	4%	12%

Chemical ..... Chemicals and allied products
Food ..... Food and kindred products
Electronics..... Electrical machinery, etc.
Heavy Machinery.. Machinery including electrical
Paper Products... Paper and allied products
Miscellaneous.... Miscellaneous manufacturing industries

A summary of types of manufacturers contacted according to number of employees designated follows in Table III:

Table III Types of Manufacturers Contacted According to Number of Employees Designated

Number of Employees	11-60	61-100	101-500	501-1000	1001-2000	over 2000
Percentage Contacted	8%	10%	48%	14%	8%	12%

* Copy of Questionnaire distributed can be found in Appendix VII.

* For complete list of Manufacturers, agencies, companies, and individuals contacted see Appendix VIII.

* See Appendix IX for list of Respondents grouped according to the Standard Industrial Classification.

* See Appendix X for list of Respondents grouped according to the number of employees designated.

f) Discussion of Results

Seventy-seven of the 111 skills/knowledge present in the questionnaire were considered either essential or desirable by the private sector responding. The skills/knowledge that were designated as essential or desirable appear below in decreasing order of importance:

Eye Safety (Shop safety)

Equipment Safety (Shop safety)
Accuracy (Measurement theory, tech. and use)

Interpretation of Charts/Graphs/Tables (Schematics)
Micrometers (Length/distance measurements)
Basic First Aid (Shop safety)
Calculators (Numerical calculations)
Calibration (Measurement theory)

Fires/Burns/Spills (Shop safety)
AD/DC (Industrial physics and electronics)
Calipers (Length/distance measurements)
Chart (Measurement theory)

Rulers (Length/distance measurements)
Meters (Reading instruments)
Electrical Switching Control (Industrial physics)
Chart Recorders (Reading instruments)
Effective Oral Presentation of Technical Material

Hand Tools for Wood, Metal Work (Shop machinery)
Meters (Measurement theory)
Polarity (Industrial physics and electronics)
Significant Figures (Mathematics for Industry)
Basic Grammar (Industrial communications)

Grinders, Drills, Other Electrical Hand Tools (Shop machinery)
Metals (Materials-selection/use/properties)
Algebra-Simple Equations/Roots/Exponents/Log Bases
(Mathematics for Industry)
Read-out Devices (Measurement theory)

Continuation of the Seventy-seven Skills

Working from a Print/Drawing (Schematics)
Dimension/Units (Schematics)
Measuring Devices (Temperature/heat)
Chemical Solvents (Materials/selection)
Ratio/Proportions (Problem solving)
Electrical Current/Voltage (Measuring Devices)
Human Body Tolerances to Chemicals (Shop safety)

Soldering (Joining/fastening)
Grease (Lubricants and use/properties/application)
Oil (Lubricants and use/properties/application)
Geometry-Angle/Areas/Volumes/Spheres (Mathematics for Industry)
How to Construct and Use Graphs, Tables (Report writing)

Data Recording (Report writing)
Lever/Gears (Basic physics)

Slide Rule (Numerical calculations)
Metric Units of Measurement (Measurement theory)
Dimensional Analysis Problem Solving (Problem solving)
Center of Gravity (Basic physics)
Letter Writing (Industrial communications)

Pressure-Liquids/Gases (Measuring devices)
Maintaining a Lab. (patent) Notebook (Report writing)
Weight (Measuring devices)

Amplification (Basic electronics)
Cleaning (Finishing techniques)
Preparing Data for Presentation (Report writing)
Detecting of Signals (Basic electronics)
Water (Lubricants/use/properties/application)
Protecting (Finishing techniques)
Air (Lubricants/use/properties/application)
Trigonometry and Trigonometry Tables (Mathematics for Industry)
Motion (Basic physics)
Sheet Metal Assembly (Shop machinery)

Rectification (Basic electronics)
Balance (Basic physics)

Coatings (Finishing techniques)
Adding Machines (Numerical calculations)

Continuation of the Seventy-seven Skills

Oscillators (Basic electronics)
Volume (Measuring devices)

Oscilloscopes (Measurement theory)
Oscilloscopes (Reading Instruments)
Heat Treating (Finishing techniques)
Color/Light (Measuring devices)
Composites (Materials-selection/use/properties)

Gases, Storages, and Handling (Materials-selection)
Metal Fasteners (Joining/fastening)
Polishing (Finishing techniques)
Hardness (Measuring devices)
Introduction to Basic Statistics-Averages/Distribution
(Mathematics for Industry)

Welding (Joining/fastening)
Tensile (Measuring devices)
Viscosity (Measuring devices)

g) Generalizations

1) Approximately 80% of industry responding ranked Shop Safety as the most essential skill/knowledge, yet only 2 schools offer courses including plant safety procedures.

2) Measurement theory, technique and use including knowledge regarding blueprints and schematics appears 3 times among the top ten most essential skills/knowledge. This appears consistent with the emphasis schools have placed in this area, as ten of the thirty-three schools require courses in this related field. It should be noted that more than one-half of the curricula used for this study required their Environmental Technology students to be proficient in drafting techniques.

3) Industrial Physics and Electronics - Again, this area rates high in employers preferences and consistently more than one-half of the thirty-three schools require physics. Six schools required applied electricity and electronics.

4) Employers also indicate a definite need for communication skills satisfied by courses in the areas of English and liberal arts.

Note: Chemistry and Biological skills/knowledge not specifically named in the questionnaire. However, Environmental Technology Topics give evidence that proficiency in these sciences are necessary for background material to gain understanding in the mentioned topics.

5) There appears to be no correlation of institutional curricula in the fields of social sciences and physical education as can be ascertained from the results of the skills/knowledge questionnaire and personal preferences obtained from employers.

IV. 5) General Recommendations

In giving recommendations that can be derived from this study, one must be consciously aware of "moderation of approach". This moderation must be used when considering every aspect of an approach. The study suggests three goals to achieve:

1) Public awareness must be increased if the environment is to be preserved and if employment opportunities to achieve this end are to be created. A general education course incorporated into current Junior College Curricula would serve this purpose. Again, moderation must be considered, for this course would have to present both sides of the Environmental-Ecology picture, i.e. all industrial concerns and their activities cannot be halted, and yet, there must be initial steps taken to curb the problem before it can be resolved.

The private sector employers have expressed much interest in the additional training in Environmental-Ecology related fields for their existing employees. As a result, these employees may serve as "authorities" in matters involving their company in EE related problems, thereby giving industry's "side of the picture."

2) We believe that, at this time, a complete Environmental-Ecology Technician Program should not be instituted in view of the results of this study. However, incorporation of a general education course or perhaps "adult education/extended day" EE courses could be made available to retrain existing employees. General education courses could be formed using suggested topics as outlined in this survey. Furthermore, courses could be made consistent with the specific needs of the San Francisco Bay Area. Employees, therefore, could become experts in EE as specific to the areas of their employers. We feel that the initiation of the above would serve to enlist the aid of the private sector and their industrial concerns in the solution of the problems concerned with EE and would help to increase public awareness. For until public awareness is heightened by means of an intellectual and factual approach, we cannot hope to create substantial job openings for Environmental-Ecology Technicians.

3) Following from the aforementioned goals, the development of a complete EE Technician Program as the employment openings become available. Inasmuch as the Community College system serves to meet the needs of its community, job positions must be existent in order to rationalize the initiation of such a program.

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Appendix I

AGENCIES CONTACTED

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Appendix II

OCCUPATIONAL CURRICULA

IN ENVIRONMENTAL EDUCATION-PROGRAMS OFFERED

IN 1970-1971

Number of Schools Offering Program	Program Description
17	Urban Development and Planning Technology
20	Marine Biology and Oceanography
4	Conservation Technology
5	Sewage Plant Operators
4	Natural Resource Management
3	Geologic Technology
5	Natural Resources Conservation
28	Environmental Health Technology
3	Marine Technology
3	Commercial Fisheries
2	Park Management Technology
4	Environmental Control Technology
5	Fish and Wildlife Technology
18	Environmental Technology
5	Air Pollution Control Technology
1	Environmental/Ecological Resource Specialist
2	Environmental Quality Control Aide
8	Wastewater Treatment Plant Operators
2	Health and Safety Technology
1	Marine Diving Technology
1	Marine Instrumentation Technology
2	Pest Control Technicians and Pesticide Technology

Appendix II (continued)

Number of Schools Offering Program	Program Description
24	Water Pollution Technology and Wastewater
7	Radiological Health Technology
1	Marine Survey Technology
1	Construction Engineering Aide
7	Environmental Engineering Aide Technology
2	Sanitary Engineering Technology
1	Environmental Laboratory Assistant
1	Community Health Assistant
3	Pollution Control Technology
3	Environmental Science
2	Solid Waste Technology and Operator Training
1	Environmental Sanitarian Assistant
1	Milk and Food Sanitarian Assistant
1	Public Health Technology
1	Marine Science Electronics Technology
1	Renewable Resources Technology

Appendix III

SCHOOLS CONTACTED: INFORMATION REGARDING

ENVIRONMENTAL CURRICULA

DUTCHESS COMMUNITY COLLEGE
Poughkeepsie, New York

KINGSBOROUGH COMMUNITY COLLEGE
Manhattan Beach
Brooklyn, New York

SANTA FE JUNIOR COLLEGE
Air Pollution Technology
Gainesville, Florida

PURDUE UNIVERSITY
School of Technology
West Lafayette, Indiana

ATLANTA AREA VOCATIONAL TECHNICAL SCHOOL
Atlanta, Georgia

KIRKWOOD COMMUNITY COLLEGE
Cedar Rapids, Iowa

SOUTHERN MAINE VOCATIONAL TECHNICAL INSTITUTE
South Portland, Maine

CONTRA COSTA COLLEGE
San Pablo, California

MIAMI-DADE JUNIOR COLLEGE
Miami, Florida

SAN DIEGO JUNIOR COLLEGES
Office of Vocational Education
San Diego, California

SUMTER AREA TECHNICAL EDUCATION CENTER
Sumter, South Carolina

STATEN ISLAND COMMUNITY COLLEGE
Staten Island, New York

MONROE COMMUNITY COLLEGE
Rochester, New York

NIAGARA COMMUNITY COLLEGE
Niagara Falls, New York

HUDSON VALLEY COMMUNITY COLLEGE
Troy, New York

ERIE COMMUNITY COLLEGE
Buffalo, New York

DELHI AGRICULTURAL & TECHNICAL SCHOOL
Delhi, New York

CORNING COMMUNITY COLLEGE
Corning, New York

BROOME TECHNICAL COMMUNITY COLLEGE
Binghamton, New York

COMMUNITY COLLEGE OF THE GINGER LAKES
Canadaigua, New York

ALFRED AGRICULTURAL AND TECHNICAL COLLEGE
Alfred, New York

MERAMEC COMMUNITY COLLEGE
St. Louis, Missouri

FERRIS STATE COLLEGE
Big Rapids, Michigan

OKLAHOMA STATE UNIVERSITY TECHNICAL INSTITUTE
Stillwater, Oklahoma

CLACKAMAS COMMUNITY COLLEGE
Oregon City, Oregon

LINN-BENTON COMMUNITY COLLEGE
Albany, Oregon

OREGON TECHNICAL INSTITUTE
Klamath Falls, Oregon

MURRELL DOBBINS TECHNICAL SCHOOL
Philadelphia, Pennsylvania

GREENVILLE TECHNICAL EDUCATION CENTER
Greenville, South Carolina

HOLYOKE COMMUNITY COLLEGE
Holyoke, Massachusetts

NEW ENGLAND INSTITUTE
Boston, Massachusetts

NORTH SHORE COMMUNITY COLLEGE
Beverly, Massachusetts

OKLAHOMA STATE UNIVERSITY
Stillwater, Oklahoma

PENTA TECHNICAL COLLEGE
Perrysburg, Ohio

MUSKINGUM AREA TECHNICAL INSTITUTE
Zanesville, Ohio

COMMUNITY AND TECHNICAL COLLEGE
Toledo, Ohio

FAYETTEVILLE TECHNICAL INSTITUTE
Fayetteville, North Carolina

SUNY, AGRICULTURAL & TECHNICAL COLLEGE
Morrisville, New York

SULLIVAN COUNTY COMMUNITY COLLEGE
South Fillsburg, New York

SUFFOLK COUNTY COMMUNITY COLLEGE
Seldon, New York

GENESEE COMMUNITY COLLEGE
1401 East Court Street
Flint, Michigan

ATLANTA AREA VOCATIONAL-TECHNICAL
Atlanta, Georgia

BERKSHIRE COMMUNITY COLLEGE
Pittsfield, Massachusetts

STATE TECHNICAL INSTITUTE AT MEMPHIS
Memphis, Tennessee

COMMUNITY COLLEGE OF DENVER
West Campus
Denver, Colorado

NEW ENGLAND REGIONAL WASTEWATER INSTITUTE
2 Fort Road
South Portland, Maine

COMMUNITY AND TECHNICAL COLLEGE
University of Toledo
Toledo, Ohio

GREENFIELD COMMUNITY COLLEGE
Greenfield, Massachusetts

BRISTOL COMMUNITY COLLEGE
Fall River, Massachusetts

BALTIMORE INSTITUTE & JUNIOR COLLEGE
Baltimore, Maryland

CHICAGO CITY COLLEGE SOUTHEAST
Chicago, Illinois

HENRY FORD COMMUNITY COLLEGE
Environmental Technology
Dearborn, Michigan

QUINSIGAMOND COMMUNITY COLLEGE
Worcester, Massachusetts

COLLEGE OF DU PAGE
Environmental Health Technology
Glen Ellyn, Illinois

WAUBONSEE COMMUNITY COLLEGE
Sugar Grove, Illinois

CHARLES COUNTY COMMUNITY COLLEGE
La Plata, Maryland

OLIVE-HARVEY COLLEGE
Chicago, Illinois

RAYMOND WALTERS GENERAL AND TECHNICAL COLLEGE
Cincinnati, Ohio

RICHMOND COLLEGE, THE CITY UNIVERSITY OF NEW YORK
New York, New York

STATE UNIVERSITY OF NEW YORK
Agricultural and Technical College
Morrisville, New York

MILWAUKEE AREA TECHNICAL COLLEGE
Milwaukee, Wisconsin

TARRANT COUNTY JUNIOR COLLEGE
South Campus
Fort Worth, Texas

ALPENA COMMUNITY COLLEGE
Alpena, Michigan

Appendix IV

CURRICULA TITLE DISTRIBUTION

OF THE

THIRTY-THREE INSTITUTIONS UTILIZED

Number of Schools Offering Program	Curricula Title
13	Environmental Health Technology
9	Water Quality - Water Pollution Control and Wastewater
4	Environmental Technology
3	Pollution Abatement
3	Air Pollution
3	Environmental Control Technology
1	Sanitary Engineering Technology
1	Solid Waste Technology

Note: In a few instances a school offered courses in more than a single area.

Appendix V

ANALYSIS OF COURSE TITLES OFFERED

GROUPED ACCORDING TO ACADEMIC DISCIPLINES

Number of Schools Offering Course	Course Title
	GENERAL ENVIRONMENTAL TECHNOLOGY COURSES AND/OR RELATED COURSE
22	Water Pollution/Wastewater Treatment, Collection & Control
14	Air Pollution Control
11	Principles of Environmental Health
7	Introduction to Environmental Technology
6	Vector Control
6	Sanitation and Sanitary Collection
6	Public Health Significance of H_2O Quality
6	Principles of Ecology
6	Solid Waste Pollution
5	Food Service Sanitation
5	Pollution-Sampling and Analysis
4	Conservation of Natural Resources
4	Principles of Air Sanitation
4	Community Action Against Pollution
3	Environmental Radiation
3	Environmental Engineering
2	Pollution Control
2	Noise Abatement

Appendix V (continued)

Number of Schools Offering Course	Course Title
	CHEMISTRY
28	Elementary Inorganic Chemistry
17	Elementary Organic Chemistry
8	Sanitary Chemistry (Usually required above two preceding)
4	H_2O Quality Chemistry
2	Elementary Biochemistry
	BIOLOGICAL SCIENCES
24	Bacteriology
18	Biology
7	General Zoology
4	Sanitary Microbiology
4	Limnology
3	Aquatic Biology
3	Epidemiology
3	Communicable Disease and Control
	ENGINEERING
17	Drafting
5	Surveying
5	Pumping and Hydraulics
2	Materials and Methods of Construction
2	Welding
	MATHEMATICS
29	Mathematics
7	Algebra and Trigonometry
2	Computer Programming
2	Statistics

Appendix V (continued)

Number of Schools Offering Course	Course Title
	PHYSICAL SCIENCES (OTHER THAN CHEMISTRY)
17	Physics
6	Applied Electricity and Electronics
2	Meteorology
2	Geology
	BUSINESS
4	Codes, Contracts, Specifications, and Estimates
3	Business Law
	SOCIAL SCIENCES
13	Psychology
10	American Institutions (Civics, Government)
9	Economics
8	Principles of Sociology
8	Social Sciences
	INSTRUMENTATION
10	Basic Instrumentation
	LANGUAGE ARTS
24	English Composition (Grammar)
15	Speech
	PHYSICAL EDUCATION & HEALTH EDUCATION
18	Physical Education
11	Health Education

Appendix V (continued)

Number of Schools Offering Course	Course Title
	MISCELLANEOUS
2	Plant Safety Procedures

Note: More than 50% of the schools contacted did require course in the following areas. They are ranked in order of decreasing importance.

1. Mathematics
2. Elementary Inorganic Chemistry
3. Bacteriology and English Composition
4. Physical Education and Biology
5. Physics - Elementary Organic Chemistry - Drafting

Appendix VI

ENVIRONMENTAL TECHNOLOGY TOPICS AS COMPILED FROM THE SYLLABI OF THIRTY-THREE REPRESENTATIVE INSTITUTIONS SELECTED FOR REVIEW

I. INTRODUCTION TO ENVIRONMENTAL TECHNOLOGY

A. Fundamentals of the Physical Sciences as Applied to Environmental Technology

1. Chemistry
   a. Chemical nomenclature (elements, compounds)
   b. Chemical properties (structure, solubility, ionization, buffering, pH, chemical constants)
   c. Chemical reactions (displacement, decomposition, oxidation, reduction, neutralization)
2. Biology
   a. Biological toxicity
   b. Water and air microbiology
      1. Basic biological laws and principles as applied to living matter
      2. Nomenclature and classification of microbial and higher aquatic plants and organisms
      3. Cultivation and identification of micro-organisms
   c. Aquatic Biology
      1. Cultivation and identification of aquatic plants and animals
      2. Principles of limnology
      3. Ecology of clean waters
      4. Ecology of polluted waters
      5. Estuarine ecology
3. Mathematics
   a. Units of expression (terminology, cgs vs. fps)
   b. Arithmetic manipulations

II. DISEASE PREVENTION TECHNOLOGY

A. Elements of Sanitation

1. Disease Transmission and Control
2. Epidemiology, Rural Water Supply and Waste Disposal
3. Insect and Rodent Control
4. Solid Waste Collection and Disposal
5. Milk and Food Sanitation
6. Swimming Pool Sanitation
7. Industrial Hygiene and Toxicology
8. Administration of Public Health
9. Water Supply Engineering
   a. Sources of supply, water demand, population prediction, water equality requirements
   b. Principles of water purification
   c. Design of water treatment plant and distribution system

B. Pest Control Technology

1. Alternatives to Present Patterns of Insect Control
2. Pesticides
   a. Competition for food between insects and man
   b. Synthetic organic pesticides
      1. Classes and properties of synthetic organic insecticides
      2. Toxicity
      3. Degradation or chemical breakdown
      4. History and beneficial effects of chlorinated hydrocarbon pesticides
      5. Extent and effects of chlorinated hydrocarbon pesticides in the marine environment
      6. Effects of chlorinated hydrocarbon pesticides on birds
      7. Chlorinated hydrocarbon pesticides in humans
      8. Alternatives to chlorinated hydrocarbon pesticides
   c. Other methods of pest control

3. Elements of Sanitation
    a. Disease transmission and control
    b. Epidemiology, rural water supply and waste disposal
    c. Insect and rodent control
    d. Milk and food sanitation
    e. Swimming pool sanitation
    f. Industrial hygiene and toxicology
    g. Administration of public health

III. POLLUTION PREVENTION & CONTROL TECHNOLOGY

A. Water Pollution

1. Water Pollution--General Considerations
    a. Classification of water pollutants
    b. Oxygen-demanding wastes
    c. Disease-causing agents
    d. Plant nutrients
    e. Synthetic organic compounds
    f. Inorganic chemicals and mineral substances
    g. Sediments
    h. Radioactive materials

2. Mercury
    a. The uses of Hg by man
    b. Sources of Hg pollution
    c. Mercury amplification in food chains
    d. Mercury poisoning and biological methylation
    e. Solutions to the mercury pollution problem

3. Lead
    a. Sources of lead pollution
    b. The behavior of lead in the body

4. Oil
    a. The fate of spilled oil
    b. Biological and physical effects
    c. Countermeasures for oil pollution

5. Detergents
    a. Pollution problems involving detergents
    b. Non-phosphate detergent formulations
    c. Effects of phosphate removal on the environment

B. Solid Waste and Wastewater

1. Solid Waste and Wastewater Sources

a. Chemical

1. Industrial contributions
2. Municipal contributions
3. Evaluative considerations

b. Biological

1. Industrial contributions
2. Municipal contributions
3. Evaluative considerations

2. Data Collection and Evaluation

a. Contributory considerations (combined, separate, recovery)

b. Volumetric considerations (flow, equalization, pumping)

c. Sampling (techniques, equipment)

d. Analytical procedures (ASTM, Standard Methods)

3. Chemical Treatment Processes

a. Neutralization

1. Techniques (mixing, retention, control)
2. Theory (acid-base reactions)
3. Equipment

b. Oxidation-reduction (Redox)

1. Techniques (destructive reactions)
2. Theory
3. Equipment

c. Ion Exchange

1. Techniques
2. Theory
3. Equipment

d. Applications

1. Process wastewaters
2. Airborne waste
3. By-product recovery
4. Wastewater reuses

4. Treatment Controls

a. Analytical monitoring

b. Instrumentation
c. Process limitations
d. Operator competence
e. Regulatory agency supervision and control

5. Biological Treatment Processes
   a. Primary treatment
      1. Techniques (sedimentation, digestion)
      2. Theory
      3. Equipment
   b. Secondary treatment
      1. Techniques
         a. Biological filtration
         b. Activated sludge
         c. Lagoons
      2. Theory
      3. Equipment
   c. Tertiary treatment
      1. Techniques (absorption-adsorption, sedimentation, filtration)
      2. Theory
      3. Equipment

6. Physical Treatment Processes
   a. Liquid-solids separation
      1. Techniques (screening, sedimentation, flotation)
      2. Theories
      3. Equipment
   b. Liquid-liquid separation
      1. Techniques (skimming, dissolved air flotation)
      2. Theories
      3. Equipment
   c. Particulate media filtration
      1. Techniques (sand, coal, activated carbon, mixed media, diatomite)
      2. Theories
      3. Equipment

d. Absorption-adsorption
   1. Techniques (activated carbon, ion exchange)
   2. Theory
   3. Equipment

e. Ultimate disposal
   1. Techniques (burial, incineration, deep well)
   2. Theory
   3. Equipment

7. Process Considerations
   a. Design criteria
      1. Loadings (hydraulic, biological)
      2. Retention
      3. Additives (chemicals, nutrients)
   b. Contributory evaluations (recovery, character, etc.)
   c. Reuse (closed cycle)
   d. Disposal techniques
   e. Pilot plant evaluations
   f. Treatment approach (batch, continuous)

8. Treatment Efficiency
   a. Chemical processes
      1. Limitations (residual concentrations)
      2. Treatment control
   b. Biological processes
      1. Treatment approach (primary, secondary, tertiary)
      2. Treatment control
   c. Physical processes
   d. Operation effects

C. Liquid Waste and Wastewater Disposal and Water Treatment Technology

1. Waste Water Treatment
   a. Hydraulic design of municipal wastewater and storm water sewer.
   b. Principles of mechanical, chemical and biological wastewater treatment systems
   c. Design of treatment plants for municipal wastewaters

2. Industrial Waste
    a. Stream sanitation
    b. Principles and procedures for industrial wastewater pollution control

D. Solid Waste Treatment & Disposal Technology
1. Solid Wastes
    a. Kinds and quantities
    b. Sources and cycles
    c. Collection
    d. Disposal methods
        1. Possible effects on air, water, and land
    e. Characteristics, quantity and quality of urban and rural refuse
    f. Technical aspects of refuse collection and methods of disposal, such as sanitary landfill, incineration and composting
    g. Government's function in solid waste management
    h. Recycling

E. Air Pollution Technology
1. Background
    a. Composition of clean air
    b. Behavior of air and other gases
    c. Quantities of emissions into air
    d. Flow, dispersion, degradation of materials in air
    e. Particles, liquid and solid
    f. Gases:
        1. Carbon monoxide
            a. Sources of CO_2 Pollution
            b. The fate of atmospheric CO
            c. Concentration and distribution of CO
            d. Effects of CO on plants
            e. Effects of CO on humans
            f. Control of CO pollution

2. Oxides of nitrogen
   a. Sources of NO_x Pollution
   b. The photolytic cycles of NO_2
   c. Concentration and distribution of NO_x
   d. Effects of NO_x on plants
   e. Effects of NO_x on humans
   f. Effects of NO_x on materials
   g. Control of NO_x pollution
3. Hydrocarbons and photochemical oxidants
   a. Basic compounds involved
   b. Hydrocarbons
   c. Photochemical oxidants
   d. Sources of hydrocarbon pollution
   e. Formation of photochemical oxidants
   f. Concentration and distribution of hydrocarbons and photochemical oxidants
   g. Effects of hydrocarbons and photochemical oxidants on plants
   h. Effects of hydrocarbons and photochemical oxidants on humans
   i. Effect of hydrocarbons and photochemical oxidants on materials
   j. Control of hydrocarbons and photochemical oxidants
4. Sulfur oxides
   a. Sources of SO_x Pollution
   b. Concentration and distribution of SO_x
   c. Effects of SO_x on plants
   d. Effects of SO_x on humans
   e. Effects of SO_x on materials
   f. Control of SO_x pollution

g. Other significant pollutants
   1. Sources of particulates
   2. Concentration of particulates
   3. Effects of particulates on plants

4. Effects of particulates on humans
5. Toxic particulates
6. Effects of particulates on materials
7. Effects of particulates on solar radiation and climate
8. Control of particulate emissions
9. Temperature inversions and the greenhouse effect
    a. Temperature inversions
    b. The greenhouse effect

2. Odor Technology
    a. General concepts - odors as a stimulus perceived by the olfactory epithelium
    b. Odor sources
    c. Odor measurement - material measuring and psychological scaling
        1. Measurement of absorption
        2. Collection by condensation
        3. Selection and calibration of perceivers
        4. Standardization of odor sample
        5. Odor intensity
    d. Odor control - dispersal, combustion, adsorption
3. Air Pollution Community Surveys
    a. Fundamental principles
        1. Effect of elevation and topography
    b. Diurnal variation of pollution concentration
    c. Seasonal variation in pollutant concentration
    d. Dust fall, airborne particulate matter, gaseous effluents
4. Health Aspects
    a. Effects of air pollutants
        1. On humans
        2. On vegetation
        3. On materials
        4. On the ecosystem

b. Epidemiological evidence for chronic health effects
c. Physical and physiological factors
d. Clinical and physiological factors
e. Community atmospheric standards
f. Cancer

5. Sampling Techniques for Ambient and Stack Gas Analysis
   a. General appraisal
   b. Procedures
      1. Selection of sampling location
      2. Instruments for measuring gas velocities in stacks
      3. Methods of measuring stack velocities
      4. Temperature measurement of stack gases
   c. Sampling methods
      1. Steps in sampling
      2. Isokinetic sampling
      3. Probes
      4. Vacuum sources
      5. Measurement of sampled gas
      6. Collecting devices for gases and vapors
   d. Practical considerations in stack sampling
   e. Calculations
6. Analysis of Specific Pollutants
   a. Analysis of air for specific organic contaminants such as hydrocarbons, aldehydes, and acids
   b. Inorganic analysis
      1. Sulfur oxides
      2. Nitrogen oxides
      3. Carbon oxides
      4. Oxidants
7. Air Pollution Instrumentation
   a. Dust fall
   b. Airborne particulate matter
      1. Filter samplers
      2. Impingement samplers

3. Precipitators
4. Photometric instruments
5. Aerosol sampling devices
6. Pollen sampling

c. Gases and vapors
1. Total carbon analyzer
2. Total hydrocarbon-analyzer
3. Infrared spectrophotometry
4. Gas-liquid chromatography
5. Correlation spectrophotometry

8. Control Technology and Design Parameters
a. Process factors affecting equipment selection
b. Mechanical collectors
1. Gravity settling chambers
2. Radiant cooling devices
3. Cyclone collectors
c. Filtration
1. Deep bed filters
2. Fabric filters
d. Wet collectors: theory of performance
e. Electrical precipitators: operating theory
f. Absorption of gases: factors controlling the effectiveness of physical absorption in dynamic systems
g. Incineration of gaseous vapors
1. Combustion process
2. Afterburner design
3. Applications and efficiency
h. Catalytic combustion
1. Principles of operation
2. Design and operation characteristics
3. Applications and efficiency
i. Performance testing
j. Disposal of collected material

9. Air Temperature and Humidity Near the Earth's Surface
   a. Factors influencing air temperature
   b. Diurnal and annual patterns of air temperature differences
   c. Precipitation and fog
   d. Humidity near the earth's surface
   e. Measurement of temperature and water vapor fluctuations
10. Wind Flow
   a. Essential problem
   b. Dimensional analysis and similarity theory
   c. Vertical wind profile in a nonadiabatic atmosphere
   d. Measurement of mean wind
11. Evaporation from Homogeneous Surfaces
   a. Evaporation process
   b. Formal relationships
   c. Ratio of diffusivities
   d. Recent experimental data
   e. Eddy correlation method for measuring evaporation
   f. Practical considerations
   g. Measurement of temperature and water vapor fluctuation
12. Wind Flow Around Obstacles
   a. Surface of the earth
   b. Wind flow around a cylinder
   c. Wind flow around irregular objects
   d. Energy balance of a closed area
   e. Effect of a tower on wind measurements
13. Atmospheric Pollution
   a. The meteorologic problem
   b. Effective stack height
   c. Aerodynamic downwash around a building
   d. Transitional zones and states
   e. Particles in the atmosphere
      1. Definition of particle size
      2. Size distribution

3. Definition of mean size
4. The troposphere
    a. Sources of particles
        1. Sea salt
        2. Forest fires, rocks, and soil
        3. Volcanoes
        4. Meteoritic dust
        5. Biological material
        6. Industrial
        7. Chemical reactions
    b. Particles size and distribution
    c. Cloud physics
        1. Condensation
        2. Cloud droplet size distribution
        3. Rain formation
        4. Hail

14. Air Over Oceans and Large Lakes
    a. Some physical properties of oceans and lakes
    b. Temperature and humidity near the water surface
    c. Wind flow over water
    d. Turbulence over water
15. Air Over a City
    a. Radiation balance of a city
    b. Conductive heat flux
    c. Heat generated by a city
    d. City temperatures
    e. Humidity in a city
    f. Winds in a city
    g. Effects on parks and greenbelts
16. Modification of Local Weather
    a. Changes in radiation balance
    b. Changes in soil heat
    c. Changes in humidity
    d. Changes in wind patterns

F. Noise Control Technology

1. Noise

a. Sound

b. Loudness and the Decibel Scale

c. The effects of noise

d. Measurement)

e. Sources) Industrial

f. Control)

g. Limits for various types of location)

h. Legal aspects)

i. Noise in the environment, other than industrial

G. Nuclear - Radiological Pollution Control Technology

1. Radioactive Fallout Formation

a. Mechanisms of fallout formation

1. Airburst
2. Surface burst
3. Underground bursts
4. Crater formation
5. Airborne particles from nuclear reactor and separation plants
6. Accidents

2. Radioactive Fallout

a. Close-in fallout

1. Base surge
2. Combined effects of meteorology and particle size
3. Prediction of fallout patterns

b. World wide fallout

1. Tropospheric delayed fallout
2. Stratospheric delayed fallout
3. Fallout from high atmosphere
4. Fallout from accidents

3. Introduction to Radiological Health
   a. Analysis of radiation hazards
   b. Unit operations and processes used in handling radioactive wastes
   c. Shielding concepts
   d. Decontamination
   e. Radioisotope identification
   f. Dosimetry
   g. Principles of detection devices

VI. RESOURCES CONSERVATION TECHNOLOGY

A. Forestry or Timber Conservation Technology
   1. Forest Meteorology
      a. Forest
      b. Radiation balance of a forest
      c. Temperature and moisture of soil
      d. Winds in the forest
      e. Forest temperature
      f. Humidity in the forest
      g. Heat storage within trees
      h. Energy balance of a forest

B. Mineral Conservation Technology
   1. Nonrenewable Mineral Resources

C. Food Production Technology
   1. Solar Energy and Food
   2. Recent History of Agricultural Production
   3. Agricultural Ecosystems
   4. The Techniques of Agriculture
   5. Agricultural Disruptions
   6. Land and People
   7. Amount of Land Under Cultivation
   8. Improving Yields on Land
   9. Food from the Sea
   10. Novel Sources of Food
   11. Reduction of Food Losses

V. MISCELLANEOUS

A. Pollution Control Equipment

1. Electrical, electronic controls of hydraulic pneumatic and mechanical equipment and components

2. Basic description, analysis and explanation of operation

a. Typical performance characteristics, limitations on performance, accuracy, applications, and their utilization in industrial processes

Appendix VII

EMPLOYEE SKILL/KNOWLEDGE SURVEY QUESTIONNAIRE

Please rank the following skills/knowledge as: 1) essential, 2) desirable, 3) unnecessary. Please add any skill/knowledge that you feel should be included in this survey.

1. Shop machinery and materials
   - A. Function/techniques/theory/use
     1. Hand tools for wood, metal work
     2. Grinders, drills, other electrical hand tools
     3. Metal-wood lathe
     4. Other
     5. Joining/fastening
        - a. soldering
        - b. welding
        - c. chemical adhesives
        - d. Metal fasteners
     6. Lapping
     7. Glass assembly
     8. Sheet metal assembly
     9. Tubing assembly-glass, metal, plastic
     10. Other
   - B. Shop safety
     1. Equipment safety
     2. Fires/burns/spills
     3. Eye safety
     4. Human body tolerances to chemicals
     5. Basic first aid

C. Materials-selection/use/properties/dispensing

1. Solids
    a. wood
    b. plastic
    c. glass
    d. metals
    e. composites
2. Gases
    a. storages and handling
3. Liquids
    a. chemical solvents
    b. emulsions
    c. suspensions
    d. other

2. Measurement theory, techniques and use

A. Theory

1. Accuracy
2. Calibration
3. Read-out devices
    a. meters
    b. chart
    c. oscilloscopes
4. Metric units of measurement

B. Function/technique/use

1. Length/distance measurements
    a. rulers
    b. calipers
    c. micrometers
2. Reading instruments
    a. meters
    b. chart recorders
    c. oscilloscopes
    d. other

3. Measuring devices
    a. temperature/heat
    b. pressure-liquids/gases
    c. color/light
    d. electrical-current/voltage
    e. humidity
    f. volume
    g. pH
    h. density/specific gravity
    i. viscosity
    j. hardness
    k. weight
    l. reflectance
    m. surface profiles
    n. tensile
    o. other

C. Schematics/blue prints/etc.
    1. Working from a print/drawing
    2. Interpretation of charts/graphs/tables
    3. Dimension/units

3. Lubricants and Lubrication

A. Use/properties/application
    1. Grease
    2. Oil
    3. Air
    4. Water

B. Theory of friction/wear

4. Mathematics for Industry
   - A. Theory
     1. Geometry-angle/areas/volumes/spheres
     2. Trigonometry and trigonometry tables
     3. Algebra-simple equations, roots, exponents, log bases
     4. Significant figures
     5. Introduction to basic statistics-averages/distribution
   - B. Practical use
     1. Problem solving
        a. ratio/proportions
        b. dimensional analysis problem solving
     2. Numerical calculations
        a. slide rule
        b. adding machines
        c. calculators

5. Industrial Communications
   - A. Theory
     1. Basic grammar
     2. Punctuation
   - B. Use/techniques
     1. Typing
     2. Letter writing
     3. Effective oral presentation of technical material
     4. Report writing
        a. data recording
        b. how to construct and use graphs, tables
        c. preparing data for presentation
     5. Maintaining a laboratory (patent) notebook

6. Industrial physics and electronics
   - A. Basic electricity-theory/practice
     1. AC/DC
     2. Polarity
     3. Electrical switching and control
     4. Other
   - B. Basic electronics-theory/practice
     1. Rectification
     2. Amplification
     3. Detecting of signals
     4. Oscillators
     5. Other
   - C. Basic physics-theory/practice
     1. Levers/gears
     2. Center of gravity
     3. Motion
     4. Balance

7. Industrial chemistry and biology-theory/practice
   - A. Distillation
   - B. Filtration
   - C. Sedimentation
   - D. Titration
   - E. Solution preparation
   - F. Sample preparation
   - G. Testing procedures
   - H. Formulation
   - I. Animal care
     1. Injection
     2. Bleeding
   - J. Sterile techniques
   - K. Handling radioactive materials
   - L. Microscopes/optical aids
   - M. Other

Appendix VII (continued)

8. Finishing techniques

A. Coatings
B. Heat treating
C. Polishing
D. Cleaning
E. Protecting
F. Plating
G. Other

Appendix VIII

MANUFACTURERS, AGENCIES, AND COMPANIES IN THE SOUTHERN SAN FRANCISCO BAY AREA CONTACTED BY SKILLS/KNOWLEDGE QUESTIONNAIRE

Kaiser Aluminum & Chemical Company
Permanente, Calif. 95014

Kaiser Cement & Gypsum
Permanente, Calif. 94014

Mark Systems
10950 N. Tantau Avenue
Cupertino, Calif. 95014

Gentry Corporation
Pacheco Pass Highway
Gilroy, Calif. 95020

Almaden Vineyards
P. O. Box 906
Los Gatos, Calif. 95030

Amphenol-Cadre Division
14600 Winchester Blvd.
Los Gatos, Calif. 95030

Bard-Parker
A Division of Becton-Dickinson, Inc.
14300 Winchester Blvd.
Los Gatos, Calif. 95030

Meadow Gold Dairies
46 No. Santa Cruz Avenue
Los Gatos, Calif. 95030

Tempress Research
University & Lark Avenue
Los Gatos, Calif. 95030

Western Microwave
16845 Hicks Road
Los Gatos, Calif. 95030

Appendix VIII (continued)

Ames Company
1001 Dempsey Road
Milpitas, Calif. 95035

Jones Chemical Company, Inc.
985 Landess Avenue
Milpitas, Calif. 95035

Kaiser Refractories Division
1600 South Main Street
Milpitas, Calif. 95035

Pierce & Stevens Chemical Co.
805 South Dempsey Road
Milpitas, Calif. 95035

United Technology Corp.
Metcalf Road
Morgan Hill, Calif.

Aerotherm Corporation
485 Clyde Avenue
Mountain View, Calif. 94040

Amelco Semiconductor
1300 Terra Bella Avenue
Mountain View, Calif. 94040

Beckman & Whitley
441 North Whisman Road
Mountain View, Calif. 94040
(Technical Operations, Inc.)

Cetec Corporation
188 Whisman Road
Mountain View, Calif. 94040

Cintra Physics International
440 Logue Avenue
Mountain View, Calif. 94040

Core Memories, Inc.
2525 Charleston Road
Mountain View, Calif. 94040

Dohrmann Instrument Co.
1062 Linda Vista
Mountain View, Calif. 94040

Appendix VIII (continued)

Electromagnetic Technology Corp.
486 Ellis
Mountain View, Calif. 94040

Electronic Arrays, Inc.
501 Ellis
Mountain View, Calif. 94040

Fairchild Semiconductor Corp.
545 Whisman Road
Mountain View, Calif. 94040

Ferry Morse Seed Company
Ferry Morse Way & Evelyn
Mountain View, Calif. 94040

Hewlett-Packard of Mountain View
690 Middlefield Road
Mountain View, Calif. 94040

International Video Corp.
67 East Evelyn Avenue
Mountain View, Calif. 94040

Lindberg Hevi-Duty
380 Logue Avenue
Mountain View, Calif. 94040

Loenco, Inc.
1062 Linda Vista Avenue
Mountain View, Calif. 94040

Mardix
943 Stierlin Road
Mountain View, Calif. 94040

Metrotech, Inc.
670 National Avenue
Mountain View, Calif. 94040

Microseal Corporation
875 Maude Avenue
Mountain View, Calif. 94040

Micro Science Associates
2274 Mora Drive
Mountain View, Calif. 94040

Monolith (A Teledyne Corporation)
885 Maude Avenue
Mountain View, Calif. 94040

Appendix VIII (continued)

Ames Research Center
Moffett Field
Mountain View, Calif. 94040

Nedco
1957 Old Middlefield Way
Mountain View, Calif. 94040

Raytheon Semiconductor
350 Ellis Street
Mountain View, Calif. 94040

Semimetals, Inc. (Elmat Division)
405 National Avenue
Mountain View, Calif. 94040

Siliconix Inc.
183 Evelyn Avenue
Mountain View, Calif. 94040

Spectra Physics, Inc.
1250 West Middlefield Road
Mountain View, Calif. 94040

Stoesser Tool & Die Company
2630 Fayette Drive
Mountain View, Calif. 94040

Sylvania Electronics Systems
505 Evelyn Avenue
Mountain View, Calif. 94040

Syntex
2349 Charleston Road
Mountain View, Calif. 94040

THP, Inc.
1155 Terra Bella Avenue
Mountain View, Calif. 94040

Ultek (Division of Perkin-Elmer Corp.)
2690 Casey Avenue
Mountain View, Calif. 94040

Union Carbide Corporation
415 Middlefield Road
Mountain View, Calif. 94040

Vidar Corporation
77 Ortega
Mountain View, Calif. 94040

Alto Scientific Company, Inc.
4083 Sherman Avenue
Palo Alto, Calif. 94306

Adcole Corporation
999 Commercial Street
Palo Alto, Calif. 94303

Alfred Electronics
3176 Porter Drive
Palo Alto, Calif. 94303

American-Lincoln Products, Inc.
916 Commercial
Palo Alto, Calif. 94303

Anadyne, Inc.
855 El Camino Real
Palo Alto, Calif. 94301

Applied Technology, Inc.
3410 Hillview Avenue
Palo Alto, Calif. 94304

B & Z Manufacturing Company
2873 Park Blvd.
Palo Alto, Calif. 94306

Beckman Instruments, Inc.
1117 California Avenue
Palo Alto, Calif. 94304

Bennett Ceramic Laboratory
660 Homer Avenue
Palo Alto, Calif. 94304

Blair Johnson, Inc.
211 Lambert Avenue
Palo Alto, Calif. 94306

Circuit Engineering Company
4024 Transport
Palo Alto, Calif. 94303

Coca Cola Bottling Company
450 Lambert Avenue
Palo Alto, Calif. 94306

Control Data
3145 Porter Drive
Palo Alto, Calif. 94303

Appendix VIII (continued)

Durrum Instrument Corporation
3950 Fabian Way
Palo Alto, Calif. 94303

Dymec Division of Hewlett-Packard
395 Page Mill Road
Palo Alto, Calif. 94306

ESL, Incorporated
3940 Fabian Way
Palo Alto, Calif. 94303

Electronic Associates, Inc.
4151 Middlefield Road
Palo Alto, Calif. 94303

Energy Systems Incorporated
3180 Hanover Street
Palo Alto, Calif. 94303

Fairchild Semiconductor
4001 Miranda Avenue
Palo Alto, Calif. 94301

FRL, Inc.
1975 University Avenue
Palo Alto, Calif. 94304

Friden, Inc.
3406 Hillview Avenue
Palo Alto, Calif. 94304

General Mills, Sperry Operation, Inc.
730 Welch Road
Palo Alto, Calif. 94304

Granger Associates
1601 California Avenue
Palo Alto, Calif. 94304

H P Associates
620 Page Mill Road
Palo Alto, Calif. 94304

Hewlett-Packard Company
1501 Page Mill Road
Palo Alto, Calif. 94304

Isotopes, Inc.
4062 Fabian Way
Palo Alto, Calif. 94303

Appendix VIII (continued)

Itek, Corporation
1450 Page Mill Road
Palo Alto, Calif. 94303

Kaiser Aerospace & Electronics Corp.
1651 Page Mill Road
Palo Alto, Calif. 94304

Kierulff Electronics
3969 E. Bayshore Road
Palo Alto, Calif. 94303

Lockheed Palo Alto Research Laboratory
3251 Hanover Street
Palo Alto, Calif. 94304

Malanco of California
250 Portage Avenue
Palo Alto, Calif. 94306

Materials Analysis Company
1060 E. Meadow Circle
Palo Alto, Calif. 94303

Melabs
3300 Hillview Avenue
Palo Alto, Calif. 94304

Micro-Magnetic Industries, Inc.
951 Commercial Street
Palo Alto, Calif. 94303

Microwave Electronics
3165 Porter Drive
Palo Alto, Calif. 94304

Optics Technology, Inc.
901 California Avenue
Palo Alto, Calif. 94304

Paeco Division of Hewlett-Packard
3215 Porter Drive
Palo Alto, Calif. 94304

Palo Alto Division of Hewlett-Packard
395 Page Mill Road
Palo Alto, Calif. 94306

Peninsula Creamery
875 Alma Street
Palo Alto, Calif. 94301

Piers Dairy Products
3070 Lewis Road
Palo Alto, Calif. 94303

Precision Instrument Company
3170 Porter Drive
Palo Alto, Calif. 94304

Philco-Ford Corporation
3939 Fabian Way
Palo Alto, Calif. 94303

Western Development Lab. (WDL)
Research & Development
3811 Fabian Way
Palo Alto, Calif. 94303

Space & Re-Entry Systems Division
3825 Fabian Way
Palo Alto, Calif. 94303

Smith Kline Instruments
Corbin-Farnsworth Division
3400 Hillview Avenue
Palo Alto, Calif. 94304

Syntex Laboratories, Inc.
3401 Hillview Avenue
Palo Alto, Calif. 94304

Varian Associates
611 Hansen Way
Palo Alto, Calif. 94304

Watkins-Johnson Company
3333 Hillview Avenue
Palo Alto, Calif. 94304

Almaden Vineyards, Inc.
1530 Blossom Hill Road
San Jose, Calif. 95120

American Bakeries Co.
1695 S. 7th Street
San Jose, Calif. 95112

Beech Nut, Inc.
1661 Senter Road
San Jose, Calif. 95150

Appendix VIII (continued)

Bidou's French Baking Co.
533 Burke
San Jose, Calif. 95112

Butler-Johnson Co.
1480 Nicora Avenue
San Jose, Calif. 95133

Caelus Memories, Inc.
567 Mabury Rd.
San Jose, Calif. 95133

California Canners & Growers, Inc. Branch #3
1193 Lick Avenue
San Jose, Calif. 95110

California Conserving Co.
1325 E. Julian Street
San Jose, Calif. 95116

California Packing Corp. No. 39
Seventh & Jackson Street
San Jose, Calif. 95112

Carnation Co., Contadina Foods Division
San Jose, Calif.

Coca Cola Bottling Co.
1555 Bayshore Hwy.
San Jose, Calif. 95112

Continental Can Co., Inc.
357 E. Taylor Street
San Jose, Calif. 95112

Del Monte Corporation, Plant 3
801 Auzerais Avenue
San Jose, Calif. 95103

Del Monte Corporation
734 The Alameda
San Jose, Calif. 95126

Del Monte Corporation
75 Tennant Avenue
San Jose, Calif. 95119

Dole Co.
5th and Virginia Streets
San Jose, Calif. 95112

Appendix VIII (continued)

Durham Meat Co.
160 Sunol Street
San Jose, Calif. 95126

Economics Lab., Inc.
640 Lenfest Road
San Jose, Calif. 95133

Eggo Food Products, Inc.
475 Eggo Way
San Jose, Calif. 95150

F M C Corp.-Canning Machinery Division
333 W. Julian Street
San Jose, Calif. 95110

F M C Central Engineering
1185 Coleman Avenue
San Jose, Calif. 95110

F M C Corp.-John Bean Division
1115 Coleman Avenue
San Jose, Calif. 95110

F M C Corp.- Ordnance Engineering
1105 Coleman Avenue
San Jose, Calif. 95110

Falstaff Brewing, Pacific Coast Division
1025 W. Julian Street
San Jose, Calif. 95126

Filter, Inc.-En Fab Division
460 E. Brokaw Drive
San Jose, Calif. 95112

Foremost-McKesson, Inc.
400 N. First Street
San Jose, Calif. 95108

Frito-Lay Inc.
650 N. King Road
San Jose, Calif. 95133

General Electric Co.
2155 S. First Street
San Jose, Calif. 95114

General Electric Company-Nuclear Energy
175 Curtner Avenue
San Jose, Calif. 95125

I B M-International Business Machines
Cottle Road
San Jose, Calif. 95114

International Minerals & Chemical Corp.
1931 S. First Street
San Jose, Calif. 95112

I T T-Jennings
970 McLaughlin Avenue
San Jose, Calif. 95116

International Paper Company
1551 Las Plumas
San Jose, Calif. 95106

Levi Strauss Co.
115 Terraine
San Jose, Calif. 95110

Levi Strauss Co.
550 Brokaw Road
San Jose, Calif. 95110

Mayfair Packing Co.
2040 Alum Rock Avenue
San Jose, Calif. 95150

Monarch Match Company
2300 S. First Street
San Jose, Calif. 95112

National Preserve Co.
665 Lenfest Road
San Jose, Calif. 95113

Owens-Illinois, Inc.
1185 Campbell Avenue
San Jose, Calif. 95150

Peninsula Steel Products & Equipment Co.
490 Phelan Avenue
San Jose, Calif. 95112

Plastronics Corp.
1600 Las Plumas Avenue
San Jose, Calif. 95133

Puritan A. D. S. Foods
665 Lenfest Road
San Jose, Calif. 95113

Reliance Tool & Die
1596 S. 7th Street
San Jose, Calif. 95129

Safeway Candy Company
999 Newhall Street
San Jose, Calif. 95126

Safeway Stores, Inc. 671-Bakery Division
999 Newhall Street
San Jose, Calif. 95126

San Jose Meat
11740 Berryessa Road
San Jose, Calif. 95133

San Jose Steel Co., Inc.
195 N. 30th Street
San Jose, Calif. 95116

Santa Clara Packing Co.
620 N. 8th Street
San Jose, Calif. 95118

Stokely Van Camp Inc.
1180 Campbell Avenue
San Jose, Calif. 95110

Sun Garden Packing Co.
1582 S. First Street
San Jose, Calif. 95110

Sunlite Bakery
145 Montgomery Street
San Jose, Calif. 95110

Sunsweet Growers, Inc.
84 W. San Antonio Street
San Jose, Calif. 95113

U. S. P. Corporation
570-600 Race Street
San Jose, Calif. 95126

United Centrifugal Pumps
1132 N. 7th Street
San Jose, Calif. 95112

Valley View Packing Co., Inc.
1095 Hillsdale Avenue
San Jose, Calif. 95123

Westab, Inc.
686 N. King Road
San Jose, Calif. 95133

F. G. Wool Packing Co.
2296 Senter Road
San Jose, Calif. 95112

American Micro Systems
Valco Industrial Park
3800 Homestead Road
Santa Clara, Calif.

Brown Company
2435 Lafayette Street
Santa Clara, Calif.

Carnation Company
Carnation Way
Santa Clara, Calif.

Certain-Seed Products Corp.
Lafayette & Kifer Road
Santa Clara, Calif.

Container Corp. of America
2500 De La Cruz
Santa Clara, Calif.

Duffy Mott Co.
Bellomy & Campbell Avenue
Santa Clara, Calif.

F M C Central Engineering Laboratories
1185 Coleman Avenue
Santa Clara, Calif.

F M C Engineering Systems Division
328 Brokaw Road
Santa Clara, Calif.

F M C Defense Technology Laboratories-Ord. Div.
333 Brokaw Road
Santa Clara, Calif.

F M C Ordnance Engineering
364 Reed
Santa Clara, Calif.

Mariani's Frozen Foods
1061 Martin Avenue
Santa Clara, Calif.

Memorex Corp.
1180 Shulman Avenue
Santa Clara, Calif.

National Semiconductor
2950 San Ysidro Way
Santa Clara, Calif.

Owens-Corning Fiberglass Corp.
960 Central Expressway
Santa Clara, Calif.

Peripheral Systems Corp.
2920 San Ysidro
Santa Clara, Calif.

Pittsburgh-DesMoines Steel Co.
3440 Lafayette Street
Santa Clara, Calif.

Stanford Applied Engineering
340 Martin Avenue
Santa Clara, Calif.

Underwriters' Laboratories Inc.
1655 Scott Blvd.
Santa Clara, Calif.

Aertech
815 Steward Drive
Sunnyvale, Calif. 94086

Ampex Corporation
Consumer & Educational Prods. Div.
Sunnyvale, Calif.

Ampex Corporation
Magnetic Disc Dept.
728 San Aleso Avenue
Sunnyvale, Calif. 94086

Ampex Corporation
Video File Information Systems Division
1020 Kifer Road
Sunnyvale, Calif. 94086

Applied Technology, Inc.
Div. Itek Corp.
Sunnyvale, Calif. 94086

Barnes-Hind Pharmaceuticals, Inc.
895 Kifer Road
Sunnyvale, Calif. 94086

Boise Cascade Container Corp.
1290 Kifer Road
Sunnyvale, Calif. 94086

California Canners & Growers, Plant 3
182 S. Fair Oaks
Sunnyvale, Calif. 94086

Data Pathing, Inc.
370 San Aleso Avenue
Sunnyvale, Calif. 94086

ESL, Inc.
495 Java Drive
Sunnyvale, Calif. 94086

Fairchild Instrumentation
974 E. Arques Avenue
Sunnyvale, Calif. 94086

General Electric Co.
Advanced Prods. Oper., Nuclear Energy Div.
310 DeGuigne Drive
Sunnyvale, Calif. 94086

Missile and Space Division
1003 W. Maude Avenue
Sunnyvale, Calif. 94086

General Recorded Tape, Inc.
1286 N. Lawrence Station Road
Sunnyvale, Calif. 94086

Icore Industries
1050 Kifer Road
Sunnyvale, Calif. 94086

International Video Corp.
Almanor & Pastoria Avenues
Sunnyvale, Calif. 94086

Libby, McNeill, & Libby
444 W. California Avenue
Sunnyvale, Calif. 94086

Link Group-Advanced Prods., Division
Singer-General Precision, Inc.
1077 E. Arques
Sunnyvale, Calif. 94086

Lockheed Missiles & Space Co.
Div. Lockheed Aircraft Corp.
1111 Lockheed Way
Sunnyvale, Calif.

Magnetics, Inc. Kemetric Plant
158 San Lazaro Avenue
Sunnyvale, Calif. 94086

Mellonics S-D
Div. Litton Industries, Inc.
1001 W. Maude Avenue
Sunnyvale, Calif. 94086

Microwave Associates, Inc.
999 E. Arques Avenue
Sunnyvale, Calif. 94086

Personal Products Co.
150 N. Lawrence Station Road
Sunnyvale, Calif. 94086

Signetics Corporation
811 E. Arques Avenue
Sunnyvale, Calif. 90486

Siliconix, Inc.
Semi-conductor Devices
1140 W. Evelyn Avenue
Sunnyvale, Calif. 94086

United Technology Center
Div. United Aircraft Corporation
1050 E. Arques Avenue
Sunnyvale, Calif. 94086

Western Electric Co., Inc.
898 Stewart Drive
Sunnyvale, Calif. 94086

Westinghouse Electric Corporation
Marine Division
Hendy Avenue
Sunnyvale, Calif. 94086

Appendix IX

MANUFACTURING COMPANIES RESPONDING TO SKILLS/KNOWLEDGE QUESTIONNAIRE GROUPED ACCORDING TO THE STANDARD INDUSTRIAL CLASSIFICATION

Chemicals and Allied Products

Underwriters' Laboratories, Inc.
1655 Scott Blvd.
Santa Clara, Calif.

General Electronics Corp.
310 DeGuigne Drive
Sunnyvale, Calif.

Pierce & Stevens Chemical Co.
805 South Dempsey Road
Milpitas, Calif.

Jones Chemical Company, Inc.
985 Landess Avenue
Milpitas, Calif.

Paper and Allied Products

Container Corp. of America
2600 De La Cruz Blvd.
Santa Clara, Calif.

International Paper Co.
1551 Las Plumas
San Jose, Calif.

Food and Kindred Products

Del Monte Corp., Plant #3
801 Auzerais Avenue
San Jose, Calif.
Canned Spinach

Food and Kindred Products Continued

Del Monte Corp.
734 The Alameda
San Jose, Calif.
Dried Fruits

Del Monte Corp.
75 Tennant Avenue
San Jose, Calif.
Canned Foods

International Minerals & Chemical Corp.
1931 S. First Street
San Jose, Calif.
Accent

Frito-Lay Inc.
650 N. King Road
San Jose, Calif.
Potato Chips

Safeway Stores, Inc.
Bakery Division
999 Newhall Street
San Jose, Calif.
Candy & Bakery

Durham Meat Co.
160 Sunol Street
San Jose, Calif.
Meat

Foremost-McKesson, Inc.
400 N. First Street
San Jose, Calif.
Dairy Products

National Preserve Co.
665 Lenfest Road
San Jose, Calif.

Machinery

Semimetals, Inc.
405 National Avenue
Mountain View, Calif.

Fairchild Semiconductor
545 Whisman Road
Mountain View, Calif.

Machinery Continued

Hewlett-Packard Co.
1501 Page Mill Road
Palo Alto, Calif.

Sylvania Electronics
505 Evelyn Avenue
Mountain View, Calif.

National Semiconductor
2950 San Ysidro Way
Santa Clara, Calif.

Micro Science Assoc.
2274 Mora Drive
Mountain View, Calif.

Aertech
815 Stewart Drive
Sunnyvale, Calif.

Electronic Arrays, Inc.
501 Ellis
Mountain View, Calif.

Watkins-Johnson
3333 Hillview
Palo Alto, Calif.

Mark Systems Inc.
Box 308
Cupertino, Calif.

Applied Technology, Inc.
Division Itek Corp.
Electronic Equipment & Supplies

Memorex Corp.
San Tomas at Central Expressway
Santa Clara, Calif.

Hewlett-Packard of Mountain View
690 Middlefield Road
Mountain View, Calif.

Lockheed Missiles & Space Co.
Division Lockheed Aircraft Corp.
1111 Lockheed Way
Sunnyvale, Calif.

Machinery Continued

Ultek Division, Perking-Elmer Corp.
Box 10920
Palo Alto, Calif.

Varian Associates
611 Hansen Way
Palo Alto, Calif.

Tempress Research
University & Lark Avenues
Los Gatos, Calif.

Data Pathing, Inc.
370 San Aleso Avenue
Sunnyvale, Calif.

Philco-Ford Corp.
3939 Fabian Way
Palo Alto, Calif.

United Technology Center
Division United Aircraft Corp.
1050 E. Arques Avenue
Sunnyvale, Calif.

FMC John Bean Division
1115 Coleman Avenue
San Jose, Calif.

FMC Ordnance Engineering
1105 Coleman Avenue
San Jose, Calif.

United Centrifugal Pumps
1132 N. 7th Street
San Jose, Calif.

Miscellaneous Manufacturing

General Recorded Tape, Inc.
1286 N. Lawrence Station
Sunnyvale, Calif.

Continental Can Co., Inc.
357 E. Taylor Street
San Jose, Calif.

Appendix IX (continued)

Miscellaneous Manufacturing Continued

Pittsburgh-DesMoines Steel
Box 329
Santa Clara, Calif.

Kaiser Aluminum
Box 870
Pleasanton, Calif.

Levi Strauss Company
115 Terrainè
San Jose, Calif.

City of Redlands
P. O. Box 280
Redlands, Calif.

Plastronics Corp.
1600 Las Plumas Avenue
San Jose, Calif.

Reliance Tool & Die
1596 S. 7th Street
San Jose, Calif.

Appendix X

MANUFACTURING COMPANIES RESPONDING TO SKILLS/KNOWLEDGE QUESTIONNAIRE GROUPED ACCORDING TO THE NUMBER OF EMPLOYEES DESIGNATED

11-61 Employees

Applied Technology, Inc.
Division of Itek Corporation
Electronic Equipment

THP, Inc.
1155 Terra Bella Avenue
Mountain View, Calif.

Pierce & Stevens Chemicals
805 South Dempsey Road
Milpitas, Calif.

Electronic Arrays, Inc.
501 Ellis
Mountain View, Calif.

Jones Chemical Company, Inc.
985 Landess Avenue
Milpitas, Calif.

61-100 Employees

Underwriters' Lab.
1655 Scott Blvd.
Santa Clara, Calif.

Semimetals, Inc.
405 National Avenue
Mountain View, Calif.

National Preserve Company
665 Lenfest Road
San Jose, Calif.

Reliance Tool & Die
1596 S. 7th Street
San Jose, Calif.

101-500 Employees

Del Monte Corp.
75 Tennant Avenue
San Jose, Calif.

Hewlett-Packard of Mountain View
690 Middlefield Road
Mountain View, Calif.

International Minerals
1931 South First Street
San Jose, Calif.

Container Corp. of America
2600 De La Cruz Blvd.
Santa Clara, Calif.

Ultek Division, Perking-Elmer
Box 10920
Palo Alto, Calif.

General Electronics
310 De Guigne Drive
Sunnyvale, Calif.

General Recorded Tape, Inc.
1286 North Lawrence Station
Sunnyvale, Calif.

Continental Can Co.
357 East Taylor Street
San Jose, Calif.

Frito-Lay Inc.
650 North King Road
San Jose, Calif.

Tempress Research
University & Lark Avenue
Scientific Research

Data Pathing, Inc.
370 San Aleso Avenue
Sunnyvale, Calif.

Safeway Stores, Inc. Bakery
999 Newhall Street
San Jose, Calif.

Pittsburgh-DesMoines Steel
Box 329
Santa Clara, Calif.

Micro Science Associates
2274 Mora Drive
Mountain View, Calif.

101-500 Employees Continued

Aertech
815 Stewart Drive
Sunnyvale, Calif.

Durham Meat Company
160 Sunol Street
San Jose, Calif.

Levi Strauss Company
115 Terraine
San Jose, Calif.

Mark Systems Inc.
Box 308
Cupertino, Calif.

FMC-John Bean Division
1115 Coleman
San Jose, Calif.

Foremost-McKesson, Inc.
400 North First Street
San Jose, Calif.

International Paper Company
1551 Las Plumas
San Jose, Calif.

Plastronics Corp.
1600 Las Plumas Avenue
San Jose, Calif.

United Centrifugal Pumps
1132 North 7th Street
San Jose, Calif.

501-1000 Employees

Varian Associates
611 Hansen Way
Palo Alto, Calif.

Hewlett-Packard Company
1501 Page Mill Road
Palo Alto, Calif.

National Semiconductor
2950 San Ysidro Way
Santa Clara, Calif.

501-1000 Employees Continued

Kaiser Aluminum
Box 870
Pleasanton, Calif.

Watkins-Johnson Company
3333 Hillview Avenue
Palo Alto, Calif.

FMC Corporation
333 West Julian Street
San Jose, Calif.

City of Redlands
Box 280
Redlands, Calif.

1001-2000 Employees

Del Monte Corporation, Plant #3
801 Auzerais Avenue
San Jose, Calif.

Memorex Corporation
San Tomas at Central Expressway
Santa Clara, Calif.

United Technology Center
Division United Aircraft Corporation
1050 East Arques Avenue
Sunnyvale, Calif.

FMC Corporation Ordnance Engr.
1105 Coleman Avenue
San Jose, Calif.

Over 2000 Employees

Del Monte Corporation
734 The Alameda
San Jose, Calif.

Lockheed Missiles & Space Co.
Division Lockheed Aircraft Corp.
1111 Lockheed Way
Sunnyvale, Calif.

Over 2000 Employees Continued

Fairchild Semiconductor
545 Whisman Road
Mountain View, Calif.

Sylvania Electronics Systems
505 Evelyn Avenue
Mountain View, Calif.

Philco-Ford Corp.
3939 Fabian Way
Palo Alto, Calif.